

FLTG Response to EPA Second Technical Review of the
Shallow Aquifer and Subsoil Remediation Facilities Design Report

Introduction

This document describes FLTG responses to EPA technical comments from their second draft review of the Shallow Aquifer and Subsoil Remediation Facilities Design Report Volumes I, II, and III. These comments were described in a letter dated July 2, 1991 from Marc Jewett, and another letter dated July 2, 1991 from Stephen D Acres. Responses to each comment are described below and have also been incorporated into the revised report being submitted to EPA in July 1991.

Response to July 2, 1991 Memorandum from Marc Jewett to Judith Black

EPA Comment 1: Revised Section 3.0— Remediation Strategy—does not seem to accurately reflect the strategy FLTG discussed with us at the groundwater meetings. FLTG verbally indicated they plan to move to enhanced restoration technologies as quickly as possible, rather than wait until later phases of the program. The discussion in Section 3.0 (page A-3-5) indicates that full-scale enhanced treatment will not start until Phase 3. The schedule on Figure 9-1 indicates that Phase 3 will not start until 18 months into the program. It was our understanding that Phase 3 was set aside strictly for facility additions and upgrades, rather than for initiation of full-scale enhanced treatment.

Response: The FLTG design will install all facilities for In Situ Bioremediation Enhanced Treatment of the entire shallow aquifer area during initial construction. The start-up of those facilities will occur in two steps, both of which occur during Phase 2. Phase 3 is set aside strictly for facility additions and upgrades. The report text is revised to consistently describe this program. (NOTE: See Response to Comment 2 regarding the Schedule shown in Figure 9-1)

Affected Text:

- Separate Executive Summary Report - Section 5.1
- Volume I Report - Section 2.1.3, Appendix A - Executive Summary, Appendix A - Sections 3.2, 4.2.1, 6.2.0, 6.2.2, 7.4.0, 7.4.1, 7.4.2, 7.4.3, 7.5, 8.0, and 9.0

2003130



01502 554

EPA Comment 2: The schedule on Figure 9-1 only extends to 24 months, yet the restoration activity is expected to last at least 4 years. FLTG should correct the schedule to reflect all the planned activities.

Response: Figure 9-1 in Appendix A is revised to reflect the schedule of Phases 1, 2, and 3 and to show that the overall remediation schedule is a 5-year program

Affected Text: Figure 9-1 and Section 9 0, both in Appendix A

EPA Comment 3: Some parts of the report make reference to a 5-year remediation period, while 4 years is used in others. FLTG should clarify and make the remediation period consistent with the assumptions used in the remedy cost estimate.

Response: The Design Plan is based on a 5-year remediation schedule as shown on Figure 7-1. The entire text has been reviewed to identify and revise any reference to a 4-year program. If any remain, it is to be considered a typographical error.

Affected Text:

EPA Comment 4: Neither the schedule nor the discussion in Section 3.0 reveal how long the six-well "mini" in-situ bioremediation assessment in Phase 2 will be run.

Response: The first step of Phase 2 will operate In Situ Bioremediation facilities on the six (6) selected wells, for a one month period before proceeding with Step 2 treatment application to the entire well field. The text is revised to state this intent.

Affected Text:

- Separate Executive Summary - Section 5.1
- Appendix A
 - Sections 3.2, 7.4.1
 - Table 3-1

EPA Comment 5: Similarly, FLTG should provide more discussion on the general "trigger" criteria that will be used to move from one phase to the next.

Response: A general description of parameters of interest and potential concerns about in situ bioremediation enhanced treatment are described in Appendix A - Sections 6 1 1 and 7 4 1.

Specific descriptions of trigger criteria have been added to the remediation strategy text

Affected Text:

- Separate Executive Summary - Section 5 1
- Volume I report
 - Section 2 13
 - Appendix A - Section 3 2

EPA Comment 6: Discussion should be added to Section 2.3 regarding FLTG's desire to monitor for contamination north of the lagoon, in response to activities at the Sikes Superfund site.

Reference should be made to the two new monitoring wells planned for this purpose, which are discussed on page A-6-12.

Response: Reference to this monitoring requirement is added to the text

Affected Text:

- Separate Executive Summary - Section 1 0
- Volume I report
 - Section 2.1
 - Appendix A - Section 3 2

EPA Comment 7: It appear Table 3-1 was revised incorrectly. In the first draft comments, we noted a number of compounds were shown on the table without accompanying detected concentration levels. We asked FLTG to confirm whether these compounds were actually observed at the site, and to eliminate those that were not.

In the revision, FLTG removed all of the compounds in question from the table. However, it appears some of these compounds are actual groundwater contaminants, as indicated by FLTG's "master" waste compound listings provided to EPA in March 1991. Most notably, toluene and trans-1,2-dichloroethene were removed from the table. These are two of the most prominent contaminants at the site (ranking seventh and third, respectively in groundwater concentration). Thus, it appears the compounds were eliminated from the table without "double checking" their reported presence.

This table is important as it sets the remediation goals and cleanup levels for the entire project. It is important that it correctly list all of the compounds and cleanup levels that FLTG will be required to meet. EPA and FLTG should work together to see that the next version is prepared correctly.

Response: Table 3-1 is revised to reflect the presence and criteria data for all compounds currently known to have been reported in the shallow aquifer groundwater analysis database

Affected Text:

- Volume I report
 - Table 3-1
 - Table 3-2

EPA Comment 8: We have not yet seen the revised QAPP. FLTG should submit this as the final step in the approval process.

Response: The revised QAPP (RAP Volume II - QA) is now issued for EPA review and approval

Affected Text:

EPA Comment 9: Two appendices (X and M) were not included with the submittal. They should be provided to complete the review process.

Response: The appendices K and M (Quality Assurance Report and Design Phase Laboratory Reports) are now issued for EPA review and approval

Affected Text:

EPA Comment 10: Some of the citations to "affected text" in FLTG's comment/response summaries are incorrect. For example, FLTG's response to EPA comment No. 9 says "there are no text changes", yet revisions were provided on page A-3-4. While this is a minor point, the response summaries are helpful "road maps" for report users.

Response: The response to Comment No 9 is revised to show the affected text reference.

Affected Text: Annotated Response Letter.

EPA Comment 11: FLTG indicated that they were revising several other portions of the document on their own (e.g., other than in direct response to EPA's comments). To facilitate review of these items, FLTG indicated they would compile and "flag" the revisions to direct EPA's attention to them. We did not see these "flags" in the second draft.

Response: All revisions in the second submittal, that were not in response to EPA comment were shown in the "shaded" portions of text in the interim report draft issued with only the affected text. This interim response draft was informally reviewed with EPA in project review meetings. All changes included in this third submittal are in response to EPA comment on the second submittal. No other revisions have been made.

Affected Text:

Response to July 2, 1991 Memorandum from
Stephen D. Acres to Judith Black

EPA Comment 1: The investigations which have been performed and those which are proposed to determine the presence and extent of DNAPLs in the subsurface have been limited in scope. It does not appear that sufficient work has been completed to fully characterize the site with respect to the presence of DNAPLs. Such fluids may serve as continuing sources for groundwater contamination. It is recommended that additional information regarding the presence of DNAPLs beneath and adjacent to the lagoon be obtained.

Depending on the results of these studies, modification of the remediation program for this site may be warranted.

Response: If DNAPLs exist, they will exist in the high contaminant concentration area within the floodwall. The design of remediation facilities for this area will be accomplished while lagoon bioremediation operation is occurring, and the facilities will be installed and operated after completion of lagoon bioremediation.

The scope of past investigations will be reviewed during the design of these facilities and any additional investigations required to investigate the DNAPLs potential will be performed at that time. Those investigations will define the existence and extent of any DNAPLs present, and their impact on the remediation schedule. The results of those investigations will then become a database to design facilities that would properly address DNAPLs remediation.

This design report will be submitted for EPA review and approval at that time.

The Volume I report text has been revised to reference that DNAPLs will be addressed as described above.

Affected Text: Volume I report - Appendix A - Section 3.1

EPA Comment 2: Sufficient supporting data to fully review the conclusions concerning the potential for contamination of hydrogeologic units below the C2 unit were not provided in the referenced document. Based on the information which was presented, current conclusions regarding remediation of this unit appear to be justified. However, continued monitoring of groundwater quality in deeper units is recommended, particularly in light of the present of subsurface DNAPLs.

Response: A portion of the 1986 supplemental remedial investigation was specifically designed and performed to verify the condition of the 2nd aquifer, and determine if monitoring or remediation action was required

The report verified that no contaminants had moved into the 2nd aquifer and that a solid aquitard existed between the shallow alluvial aquifer and the 2nd aquifer. The study concluded that no further monitoring or remediation action was needed for the 2nd aquifer. EPA agreed with that conclusion, and thus no monitoring of the 2nd aquifer is included in this remediation plan.

Affected Text: None

EPA Comment 3: A general proposal for conducting a bioremediation field study downgradient of the lagoon was included. This study was proposed for initiation during Phase II of the remediation program. Specific details concerning this proposal were not provided. It is recommended that a detailed plan and the results of any treatability studies which have been conducted in support of this plan be forwarded to RSKERL for review prior to implementation.

Response: FLTG does not plan to perform a detailed in situ bioremediation field study. The system will be started up, operated, and monitored as described in the basic operating plans contained in Sections 6.1.1 and 7.4.1 (Appendix A) and other parts of the design report. The initial oxygen/nutrient concentration management will be based on industry experience with in situ treatment systems. As soon as system stability is established, the initial data regarding actual mechanical and chemical operating details will be assessed to confirm overall system viability. The site specific data on the overall operating system will provide a representative basis for any necessary adjustments to the system. All data results during this operation will be submitted for agency review and comment.

Affected Text: None

FLTG Response to EPA Technical Review of
Shallow Aquifer and Subsoil Remediation Facilities Design Report

Introduction

This document describes FLTG responses to EPA technical comments which were presented in a March 26, 1991 letter from Ms. Judith Black (U.S. E.P A) to Mr Richard Sloan (FLTG, Inc.). The letter included two documents: a memorandum from CH2M Hill (March 21, 1991) to Ms. Black, and a letter from the EPA Robert G. Kerr Environmental Research Laboratory (March 19, 1991) to Ms. Black. Responses to each of these documents are presented in order of the numbered comments.

Response to March 21, 1991 Memorandum from CH2M Hill to Ms. Black

EPA Comment 1: A plan-view figure should be provided that shows the extent of the capture zone that will be created by the recovery well network. The capture zone should be shown as an overlay to the "plume extent" map, to verify that adequate capture is created.

Of special concern is the need to provide sufficient capture on the east side of the lagoon. Contaminant levels at Well ERT-34 suggest the need for this capture on the east side. Please show that such capture has been factored in to the approach.

Response: Figure A-4-2, which presents the composite extent of plume and the well field has been modified to include estimated zones of hydraulic capture.

After the lagoon has been remediated and backfilled (24-30 months), the hydraulic capture zone will expand to encompass groundwater in the vicinity of ERT-34.

Affected Text: Figure A-4-2, Section A-2.3, Section A-4.2, Section A-7.2.

EPA Comment 2: Please provide additional supporting information to verify that groundwater remediation is not necessary to the north of the French lagoon. The data for wells GW-13 and GW-12 should be discussed to help support this argument.

Response: GW-12 is screened from 132 to 152 feet below the surface. The well was sampled four times between November 1983 and November 1985. Analyses of sampled waters (GC/MS) for volatile organic compounds, semivolatile organic compounds, pesticides, PCBs and phenolics detected one compound - bis(2ethylhexyl)phthalate. The compound was detected on each sampling occasion. This detection was considered a sampling or laboratory interference because the compound is commonly found in PVC gloves and tubing used during analyses; and the compound was detected at similar levels in other wells from the same sampling events. GW-13 is screened from 4 to 24 feet below the surface. The well was sampled in November 1983 and in July 1984. Volatile organic compounds, semivolatile organic compounds, pesticides and PCBs were not detected. These data, in conjunction with Figure A-2-2 were used to conclude that remediation in the vicinity of these wells will not be required.

Affected Text: Section A-2.3

EPA Comment 3: Please add new well pairs FLTG 3/4, FLTG 9/10, and FLTG 13/14 to the routine quarterly monitoring program. Of interest are the detections of 1,2-Dichloroethane (in FLTG-10) and 1,2-Dichloropropane (in FLTG-3) during the Fall 1990 sampling event. Follow-up data may help substantiate that these detections are "anomalous", as FLTG concludes.

Response: Monitoring wells FLTG-3, FLTG-4, FLTG-9, FLTG-10, FLTG-13 and FLTG-14 have been included in the present quarterly monitoring program. The quarterly monitoring program will be replaced with the remediation monitoring program described in Section A-6.5. These wells have also been included in the remediation monitoring program.

Affected Text: Tables A-6-1, A-6-4, A-6-5, A-6-7, Section A-6.5.

EPA Comment 4: Please clarify FLTG's latest position concerning the need for and timing of enhanced groundwater restoration actions. We highly support FLTG's phased approach to the groundwater restoration effort. However, if FLTG's goal for final restoration remains at 4 years, enhanced technologies will need to be implemented fairly early into the program, with little room for experimentation. If the remediation goal is longer than 4 years, the phased approach becomes more attractive.

The design report concluded that remediation times longer than 4 years would most likely be necessary, but at the Denver meeting, 4 years was reiterated as FLTG's "target" remediation time frame. Please clarify.

Response: The Design Report has been revised to reflect that enhanced shallow aquifer remediation facilities will be installed as part of the initial construction program. The plan described in the Design Report provides for a phased installation of withdrawal/reinjection wells, groundwater treatment facilities, and application of the selected enhanced treatment operation. The phased installation sequence provides for each phase of these 3 elements of the project to be followed by an assessment of the actual impact of the preceding phases operation.

This phased approach will allow FLTG to optimize the overall economic balance between ultimate capital facilities requirements and the actual time required to achieve shallow aquifer remediation. The FLTG objective is to achieve that economic balance. The actual achievable schedule will be dictated in large part, by the actual characteristics of the aquifer and how rapidly it desorbs the waste material.

Affected Text: Section A-3.0, Table A-3.1, Section A-7.4, Section A-7.4.1, Section A-6.5.1

EPA Comment 5: Please provide FLTG's proposed long-term monitoring plan (including schedule and "shutoff criteria") for the groundwater restoration activity. There were concerns raised at the Denver meeting regarding the need for 30-year monitoring throughout the area of the plume. Of interest is the need to address the "bounce-back" phenomenon that will accompany the initial achievement of the remediation criteria values.

Response: The 30-year monitoring program is not described in the Design Report. It will be described in the Post-Closure Plan to be submitted to EPA as remediation action nears completion. (See Project Schedule in Figure 7-1 in Volume I). The 30-year monitoring will be designed to assess groundwater quality at the downgradient property line of the French Limited Site.

The Shallow Aquifer Design Report describes monitoring to be performed for 5 years, in the area of the plume being remediated. This monitoring will report when remediation is complete and verify that no "bounce-back" occurs during the 5-year period. The 5-year monitoring program described in the Design Report is not intended to replace the 30-year property line monitoring to be described in the Post-Closure Plan.

Affected Text: There are no text changes

EPA Comment 6: Table 3-1 (the Shallow Aquifer Groundwater Remediation Criteria) appears to be incomplete. Please provide the missing detected concentration values, or eliminate the compounds from this list that were not actually detected.

Response: Tables 3-1 and 3-2 (Volume I) have been revised to eliminate the compounds from the list that were not detected or had no health criteria requirement.

Affected Text: Tables 3-1 and 3-2 (Volume I)

EPA Comment 7: The detection limits summarized in Table 3-1 will need to be revised to address those compounds that have MCLs (or 10 to the minus 6 risk values) that fall below CLP detection limits. The Safe Drinking Water Act analytical methods (the 500 series methods) should be considered to address this concern. Please revise appropriate portions of the QAPP as necessary.

Response: Revised analytical methods have been identified that permit all French Limited project criteria to be set based on health criteria. Based on these revised methods, the analytical detection limit does not prevent the use of health criteria concentrations.

A letter describing the recommended new analytical methods has been prepared by the Project QA Officer. A revision to the Remedial Action Plan - Volume II and III - Quality Assurance will be prepared based on those recommendations after EPA approval of the letter.

Affected Text: Table 3-1 and 3-2 (Volume I)

EPA Comment 8: Appendix O presents FLTG's design basis for the groundwater treatment system. At the Denver meeting, FLTG provided clarification as to how they arrived at the design concentrations for the contaminants presented in Appendix O, Section 4. FLTG also indicated at the meeting they plan to manage influent concentrations during operations by the blending of waters from various parts of the aquifer.

We agree there is uncertainty in the expected influent concentrations, and that variability in concentration levels will be seen during operations. FLTG should provide additional text in Appendix O that reflects the insights presented during the Denver discussions. Of interest are the following: 1) the uncertainties in the influent concentrations and how they were accounted for in the design; 2) the process controls (including groundwater blending) that are available to handle variable concentration levels; and 3) the monitoring activities that will be performed to determine process-control requirements.

The objective is to show clearly that groundwater recovery operations will not be compromised or limited by treatment plant operations or design considerations. The text should discuss the flexible features of the system and explain that the plant is easily expandable in the event the water is more difficult to treat or organic loads are higher than anticipated.

Response: Text was added to Section O-2.3 to elaborate on the uncertainties in influent concentrations and how they were accounted for in the design.

Text and operating instructions will be included in the Detailed Operations Instruction Manual prepared by the operating organization to detail the following:

- a. Instruction for management of flow-rates from individual withdrawal wells to assure that waste concentrations do not exceed GWT Plant treatment capacity
- b. The monitoring activities that will be performed to guide the process control action.

The GWT Plant was designed based on predicted, and desired overall withdrawal flowrates and water quality. Actual conditions may show that GWT operation does place a restriction on shallow aquifer withdrawal operation. Depending on the nature of the restraint, the GWT Plant may be incrementally expanded, or the restraint may be accepted as the limit on shallow aquifer remediation schedule. This concept will be explained in Section O-2.3.
Affected Text: Section O-2.3

EPA Comment 9: FLTG should consider a backup source of clean water (such as from a deeper water supply well) for reinjection water needs. At present, it appears reinjection actions are vital and necessary components of the groundwater recovery program. However, the current design relies on the groundwater treatment plant to produce all of the reinjection water, without any provisions for redundancy. Under this design, reinjection (and hence groundwater remediation) depends 100% on reliability of the treatment plant. It may be advantageous to have an alternate supply of reinjection water available.

Response: The reinjection water quality requirements caused the addition of the metals precipitation step which is a rather minor cost and complexity increment in the overall groundwater treatment system. A deep-well source for reinjection water was considered, and rejected for the following reasons:

- a. The ability to continue re-injection if the GWT plant is shutdown is not required because should that happen, shallow aquifer withdrawal would also be shutdown. With GW withdrawal shutdown with continued reinjection would quickly create a "mounding" effect that is not desired.
- b. The chemistry of water from a deep aquifer will be different from shallow aquifer GW. This would offer potential negative impact on long-term withdrawal/reinjection system operation due to unexpected precipitation, crusting, etc.
- c. Economically, the cost of construction and operation of a deep-well to provide reinjection water was assessed as greater than the cost of the metals precipitation step in the GWT plant.
- d. Reinjection of shallow aquifer GW was concluded to have less overall environmental impact than using a deep-well source. The deep-well would require registration/permitting with the subsidence district agency, and would impact that aspect of the environment.

Affected Text: Separate Executive Summary - Section 5.1
Volume I - Section 2.5.1
Appendix A - 3.1

EPA Comment 10: It was unclear to what degree the reinjection water quality needs affected the design of the treatment plant. Was an alternate source of reinjection water considered as an option to reduce the scale and comprehensiveness of the treatment plant? It appears the need to treat the reinjection water to drinking water standards may have made the plant more complex than originally intended.

Response: See response to Comment 9.

EPA Comment 11: What are the North Zone and South Zone well designations shown on the process flow diagram (GWT PFD-1)? Are these designations referring to the upper (S-1) and lower (INT) wells used in other portions of the design report?

Response: GWT PFD-1 was revised to eliminate the confusing reference to north and south zones. The drawing now matches shallow aquifer remediation system P&ID.

Affected Text: GWT PFD-1

EPA Comment 12: Process Stream Number 5 (lagoon water) should be shown on the process flow diagram as an Intermittent stream, and that it originates from the lagoon treatment cell after it has undergone bioremediation.

Response: GWT PFD-1 was revised to indicate that process stream 5 is intermittent. This stream is for lagoon water level control and is not for lagoon dewatering after bioremediation is finished.

Affected Text: GWT PFD-1

EPA Comment 13: The process flow diagram should include tank No. T-21 (the groundwater collection tank). We understand that pumped groundwater does not go directly to the T-101 equalization tank as shown on the diagram; rather, it goes to T-21 first, and then to T-101.

Response: GWT Drawing PFD-1 was revised to show T-21 and the systems feeding directly to T-1-7 as shown on the shallow aquifer remediation system P&ID

Affected Text: GWT PFD-1

EPA Comment 14: On page A-E-1 a limit to the extent of the remediated area is set. It is stated as the first 55 feet of soil beneath the site and a maximum southward distance of 550 feet from the property line. The design should allow for the possibility of extending the remediation zone if the samples to be taken during installation of the system show that is necessary.

Response: The design allows for potential expansion of the well field if it is found to not hydraulically capture all groundwaters south of Gulf Pump Road which exceed cleanup criteria. This was clarified in the text.

Affected Text: Section A-2.2 and Section A-2.3.

EPA Comment 15: At the bottom of page A-4-8 the locations of monitoring wells within the remediated zone are discussed. Preliminary locations are shown Figure 4-2. It appears that the majority of the monitoring wells that are to be used to judge the progress of aquifer flushing are located along the diagonals of the five-spot flushing cells. The flushing at these locations will probably be much more rapid than in the stagnation zones midway between adjacent injection wells. This could bias the monitoring system and cause it to indicate more rapid cleanup than is actually taking place.

Response: The numbers and preliminary placements of monitoring wells were evaluated. It was found that four wells which had been identified on Table A-6-4 as monitoring "high gradient areas" are actually located in "low gradient" areas. The following table summarizes the wells which will monitor high and low gradient areas.

Formation	Low Gradient	High Gradient
INT	INT-74,INT-76,INT-77,INT-78, INT-81,INT-83,INT-85,INT-86, INT-88,W3	INT-75,INT-79,INT-80, INT-82,INT-84,INT-87, REI 6-1,REI 10-2
S1	S1-58,S1-60,S1-62,S1-63,S1-64, S1-66,S1-68,S1-70,FLTG-8	S1-59,S1-61,S1-65,S1-67, S1-69,P-5

There will be 10 INT wells in low gradient areas and eight INT wells in high gradient areas. There will be nine S1 wells in low gradient areas and six S1 wells in high gradient areas. We feel this to be an appropriate allocation of wells. However, once the system is operational, Phase 3 upgrades allow for adjustment of the monitoring system should this be necessary.

Affected Text: Table A-6-4, Section A-6.5.1

EPA Comment 16: Table 4-5 in Appendix A lists ranges of estimated flow rates for the extraction wells as well as the flow rates that are thought to be most likely. Some explanation should be given for the source of the ranges and how these estimates were used in sizing the groundwater treatment system. If all of the maximum values in the ranges are added up, the total flow rate is 570 gpm, which is greater the treatment plant capacity. The sum of the most likely values is 307 gpm. Please provide some additional discussion as to how the treatment plant design flow rates were determined.

Response: Table 4-5 provides an estimated flowrate range and a likely flowrate for each well. The estimated flowrate range was obtained through sensitivity analyses of the flow models (Appendix F). These analyses included varying transmissivities and grid cell sizes to determine the effects on estimated flowrates. The flowrate ranges are to be used for sizing pumps and to indicate the degree of uncertainty associated with the likely flowrates. The likely flowrates were estimated from simulations which used the best estimates for transmissivity and leakage between the S1 and the INT.

The maximum value of the flowrate range is not expected at each well location. Therefore, the sum of maximum flowrates was not used to determine the groundwater treatment plant capacity. The plant capacity was determined by adding a contingency of approximately 50% to the sum of most likely flowrates (307 gpm). This provided a plant capacity of 450 gpm. The text has been clarified.

Affected Text: Section A-4.2.2

EPA Comment 17: On page A-5-7 baseline slug testing of the wells is called for as an aid in tracking well efficiency. This is good. However, we believe baseline specific capacity testing should also be done. Specific capacity is a more practical parameter for judging changes in the efficiency of operating wells.

Response: We agree that specific capacity should be used as an indicator of well efficiency. The plan includes regular (including at startup) measurement of water levels and flowrates. The fact that these measurements will be used to calculate specific capacity has now been emphasized in the text.

Affected Text: Section A-5.3.3, Section A-6.3, Section A-7.3.2, Table A-6-3.

EPA Comment 18: On page A-7-14 there is a discussion of Phase III system upgrades. No mention is made of EPA involvement in the decisions that will be required to implement possible system modifications. Please reference the need for EPA's involvement at this stage of the project.

Response: The text has been changed to include EPA review of Phase 3 system upgrade plans. In addition, data will be reviewed on a weekly basis and operational meetings will be held on a monthly basis..

Affected Text: Section A-7.0, Section A-6.2.1, Section A-7 5, Section A-8.0

EPA Comment 19: On page D-5-18 the method of estimating sheet-pile wall leakage from the constant rate pump test is described. An image well procedure is used. It is stated that the difference between the image well rate required for a full no-flow boundary and the rate required to match the time-drawdown curve is equal to the rate of leakage through the wall. This is an incorrect application of image well theory.

The most reliable way to estimate wall leakage is by numerical simulation of the aquifer test. In the end this is the estimate that was actually used. We feel the image well approach can be deleted from the report.

Response: The results of image well analyses have been deleted from Appendices A and D.

Affected Text: Section A-2.1, Section A-10.0, Section D-5.3.5, Section D-5.3.6, Table D-6.1

EPA Comment 20: In Appendix E, several different types of pore volume calculations are done. There are 1-dimensional pore volumes, cylindrical pore volumes, and pore volumes based on the total volume of the aquifer. The definitions of the different pore volumes are often unclear, as are the relationships between them as the analysis progresses. This should be clarified. In general, however, we agree with the overall conclusion that it is unrealistic to expect that the aquifer will be remediated in four years.

Response: The text has been altered to make clear distinctions between total pore volumes, effective pore volumes and control pore volumes.

Affected Text: Section E-2.2, Section E-2.4, Section E-2.4.3, Section E-3.3.1, Section E-3.3.1.1, Section E-3.3.3.1, Section E-3.3.3.5, Table A-4-2

EPA Comment 21: On page F-8-3 the reference to the work of Goltz and Roberts (1986) appears to imply that equation (3) describes their statement of a first order rate law for desorption. Actually, the first order rate law used by Goltz and Roberts is much different than that given in equation (3). Please clarify or elaborate.

Response: The text has been clarified to indicate that a modified version of the Goltz and Roberts (1986) equation was used.

Affected Text: Section F-8.3.2.

EPA Comment 22: On page F-9-1 it is explained that the modified random walk code produced for this project could not be validated against laboratory data because of the high fluid velocities used in the laboratory column tests. It is also stated that the modified version of the code was verified against the results of unmodified versions to show that the fundamental transport algorithms were not altered. However, there has been no verification of the code modifications that are intended to simulate nonequilibrium sorption.

CH2M HILL does not endorse the modified random walk code as an appropriate model for simulating solute transport with nonequilibrium sorption, and does not believe that the simulations run with this model are essential to the design of an effective remediation system. In spite of our reservations concerning the modification to the transport model code, we do not find that the protectiveness and potential for success of the proposed remedy have been compromised through its use. We recognize FLTG's desire to conservatively estimate the desorptive behavior of the sediments, and we are in agreement with FLTG that a phased "observe and respond" approach is needed for successful remediation of the site.

Response: The comment is correct.

Affected Text: There are no text changes.

EPA Comment 23: It would be helpful if FLTG replaced the "future tense" work plan discussions in the report with an executive summary of the remedy. The report should spotlight situations where deviations from the RAP workplans were necessary; otherwise, just incorporate the workplans by reference.

Response: Volume I - Section 2.0 has been eliminated and replaced with an Executive Summary.

Affected Text: Volume 1

EPA Comment 24: When changing information as a result of these comments, please check for "ripple-throughs" in other sections of the report that may occur as a result of the changes. This is important for the information that appears twice in separate portions of the report.

Response: Checking for "ripple-through" effects has been performed

Response to March 19, 1991 Letter From Kerr Laboratory to Ms. Black

EPA Comment 1: Subsurface sources for continued ground-water contamination at this site include DNAPLs and contaminants adsorbed to aquifer materials. The immiscible phase liquids may exist as mobile fluid masses or as immobile residual contaminant masses trapped within soil pores by capillary forces. Contaminants in these phases provide sources for continued ground-water contaminants.

The proposed remediation system is primarily designed to address dissolved contamination and to provide hydraulic containment. It is noted that Phase II of the remedial action plan includes evaluation and implementation of enhanced remediation technologies (i.e., bioremediation and soil vapor extraction). Such techniques may increase the efficiency of the remediation system and may address the sorbed constituents. However, the proposed system may not provide the most efficient design for remediation of the subsurface DNAPLs at the site. The length of time required for remediation and the overall success of the program will depend, in part, on the extent of subsurface DNAPL contamination and the choice of the most appropriate remediation system.

The existence of dense non-aqueous phase liquids is indicated by the stained soils and elevated constituent concentrations found in deep borehole DB-20. Additional information concerning the horizontal and vertical extent and mobility of subsurface DNAPL contamination beneath and adjacent to the lagoon should be obtained. This may be best accomplished by observing or analyzing soil samples from borings. In the region south of the lagoon, it is recommended that soil samples be collected during installation of many of the proposed wells and observed for evidence of these fluids.

Response: The design report provides for sampling of soils from the top, middle and bottom of the INT and the S1 during installation of certain wells. In the vicinity of DB-20, these wells are: INT-75, INT-80, INT-88, S1-12, S1-21, S1-22, S1-46 and S1-61 (see Table A-5-3). The numbers and locations of these soil samples are appropriate for providing the data for evidence of DNAPL.

Affected Text: There are no text changes.

EPA Comment 2: The extent of ground-water contamination upon which the remediation system is designed does not include all areas in which constituents were detected at concentrations above the proposed clean-up criteria. Concentrations of 1,2-dichloroethane and 1,2-dichloropropane above proposed goals were detected in well 10 and in wells FLTG-3, 5, and 6, respectively. These results were interpreted to be anomalous. It is recommended that additional data be acquired to determine whether these constituents are present at the indicated concentrations.

Response: See response to Comment 3 of the CH2M Hill memorandum.

EPA Comment 3: It is not clear that the capture zone of the proposed extraction system is projected to encompass the full extent of ground-water contamination depicted in Figure 2-8 of the report. It is noted that the text concludes that hydraulic containment will be established. However, it is recommended that additional supporting information defining the projected capture zone be presented.

Response: See response to Comment 1 of the CH2M Hill memorandum.

EPA Comment 4: The water quality sampling of certain extraction wells prior to operation is proposed. The revision of isoconcentration maps and the relocation of injection/extraction wells based on the analyses of these samples is also proposed. It should be noted that the design and construction considerations for these wells differ significantly from those of a ground-water monitoring well (e.g., the proposed use of chemical treatment during well development). For this reason, it is recommended that the results of these initial water quality analyses be viewed as qualitative in nature.

Response: We agree with this statement.

Affected Text: There are no text changes.

EPA Comment 5: The site specific information concerning the degree of subsurface heterogeneity is limited. Ground-water monitoring data from wells located between the South Pond and the East Pond indicate that zones of relatively high transmissivity in this area may serve as preferential paths for contaminant transport. It is recommended that the information obtained during the installation, hydraulic testing, and operation of the proposed remediation wells be used to aid in identifying these and other zones of increased transmissivity.

Response: We agree with this statement. It should be noted that the placement of wells on Figure A-4-2 was guided by isopleths of sand thickness, isocons, contours of top of formation elevation and zones in which sediments became coarser. The data obtained during installation and operation may be used to revise and calibrate flow and transport models.

Affected Text: Section A-7.3.1

EPA Comment 6: Ground-water monitoring data for units below the INT unit were not presented. However, the results of slug tests conducted in two piezometers (P-1 and P-2) screened within the upper portion of the C2 unit indicated that the hydraulic conductivity in the vicinity of these wells was significantly greater than expected. The report attributes the rapid responses in these wells to fissures within the upper portion of the C2. It is noted that additional results from deeper portions of this unit yield significantly lower hydraulic conductivities. It is not clear from the report that sufficient data exist to eliminate units below the INT unit as potential transport pathways, particularly in regions which may be contaminated with DNAPLs. It is recommended that all available data be reviewed and additional monitoring wells installed, as appropriate.

Response: The C2 was determined to be a significant aquitard by the Hydrogeologic Characterization Report (AHA, 1986, Section 3.3.2). Investigations of the clay included lithologic logging of borings, hydrograph interpretation of three C2 piezometers, slug tests of two C2 piezometers, laboratory consolidation tests, and analysis of C2 piezometer drawdown during pumpage from an underlying sand. These investigations found the C2 to be laterally continuous, between 61 and 93 feet thick, with an average hydraulic conductivity of 7×10^{-7} cm/sec. Based on the pump test data, a central portion of the C2 is an aquiclude. These results, plus the lack of contaminants in deep monitoring wells, were used to determine that remediation below the INT is not required.

Affected Text: Section A-2.2, Section D-5.2

Verbal Comments received in Project Review Meeting to revise Section 3.4 on ARARs

Response: Section 3.4 (Volume I) has been revised

Affected Text: Section 3.4 (Volume I)